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Short Communication

LIGHT MICROSCOPIC STUDIES ON THYMUS OF CHICKEN (GALLUS DOMESTICUS)

T. A. KANNAN, GEETHA RAMESH*, S. USHAKUMARY, G. DHINAKAR RAJ[1] and S.VAIRAMUTHU
Department of Veterinary Anatomy & Histology, [1]Department of Animal Biotechnology
Madras Veterinary College, Tamil Nadu Veterinary & Animal Sciences University, Chennai - 7

SUMMARY

Light microscopic studies on thymus were done in layer chicken of various age groups ranging from day-old to forty weeks. The thymic gland was surrounded by a thin connective tissue capsule. The connective tissue septa divided the gland into lobules with a dark outer cortex and a pale inner medulla. In thymic parenchyma, lymphocytes or thymocytes, reticuloepithelial cells, myoid cells and macrophages were the predominant components and the other cell types occasionally observed were erythrocytes, granulocytes, mast cells and plasma cells. The Hassall's corpuscles were composed of concentrically arranged reticuloepithelial cells. The myoid cells were found mainly in the medulla. The onset of involution was observed in twenty week-old birds and marked involutary changes were noticed at forty weeks.

Key words: Thymus, chicken, light microscopy

The primary and secondary lymphoid organs are the main components of immune system in vertebrates. The thymus gland is a central lymphoid organ in which bone marrow-derived T-cell precursors undergo differentiation, maturation eventually leading to migration of positively selected thymocytes to the peripheral lymphoid organs such as the spleen (Savino and Dardenne, 2000) and gut associated lymphoid tissue including the caecal tonsil and the lymph nodes (Ciriaco *et al.*, 2003).

Tissue for the light microscopic study of thymus in layer chicken was collected from six different age groups i.e. day-old, four, eight, twelve, twenty and forty weeks. Six birds were used in each age group. The birds were procured from Poultry Research Station, Nandhanam, Chennai. The tissue pieces were fixed in 10 % neutral buffered formalin and Bouin's fluid. The fixed tissues were dehydrated in ascending grades of alcohol, cleared in xylene and embedded in paraffin wax. Tissue sections of 3-5 µ were stained by routine haematoxylin and eosin staining method and Masson's trichrome method for collagen and muscle fibres (Bancroft and Stevens, 2007).

In chicken, the thymic gland was surrounded by a thin connective tissue capsule having collagen and a few elastic fibres. The connective tissue septae from the capsule entered the gland and divided it into the lobules. The parenchyma was observed to have a dark outer cortex and a pale inner medulla within the lobule in day-old, four weeks and eight weeks of age groups (Fig.1). The ratio of cortex to medulla of the thymus in day-old chick reversed in adult age group which is in agreement with the findings of King and McLelland (1981).

The outer cortex was packed with numerous lymphocytes of various sizes in all age groups. Reticuloepithelial cells were also present in the cortex which formed the Hassall's corpuscles (Fig. 1). Cooper *et al.* (1966) opined that the small lymphocytes in the cortex represented thymus dependent lymphocytes in birds. Similarly, bursa dependent lymphocytes were morphologically represented by large lymphocytes and plasma cells. The inner medulla had various sizes of lymphocytes with predominant lymphoblasts in day-old and four week age groups. Numerous reticuloepithelial cells which formed the Hassall's corpuscles were also noticed as reported by Sabiha *et al.* (1998) in chicken.

Small and medium sized lymphocytes were found to be numerous and tightly packed in the cortex than medulla in all the age groups studied. Lymphoblasts were noticed in day-old and four week

*Corresponding author: rameshgeeth@gmail.com

age groups in the present study. Similar observations have been reported earlier in mammals (Dellmann and Brown, 1998).

The reticuloepithelial cells were stellate shaped with large nucleus and eosinophilic cytoplasm and were found more in the medulla (Fig. 2). Boyd *et al.* (1983) reported that these reticuloepithelial cells released humoral factors essential for the production, development and maturation of the lymphocytes in bursa and thymus of chicken. In all age groups studied, myoid cells were noticed in the medulla (Fig. 3) which were seen as elongated, spindle shaped cells with striations. The presence of myoid cells was also confirmed by the Masson's trichrome staining. Number of myoid cells was found to be more at 40 weeks of age as compared to younger age groups. This leads to a postulation that these myoid cells directly or indirectly, may be related with the involution of the organ, which is functional synchronization with the amount of sex hormone present in the blood (Vijayaragavan, 1988).

Macrophages were also seen as one of the cellular components both in the cortex and medulla in birds of all age groups. The presence of macrophages can be considered as one of the common defense mechanism existing in birds, parallel to the findings of Kendall (1984) in man. Mast cells and plasma cells were observed throughout the thymic parenchyma. Increased number of mast cells was observed in four

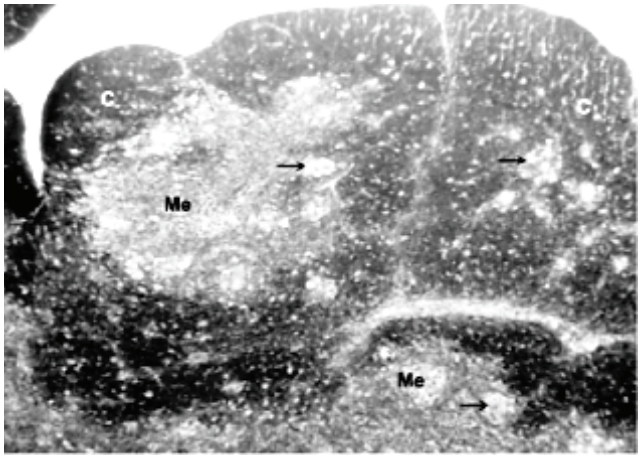

Fig 1. Photomicrograph of thymus of a four week-old chicken showing a dark outer cortex and an inner pale medulla with Hassal's corpuscles (Arrows). (H. & E. x 100)
C=Cortex; Me=Medulla

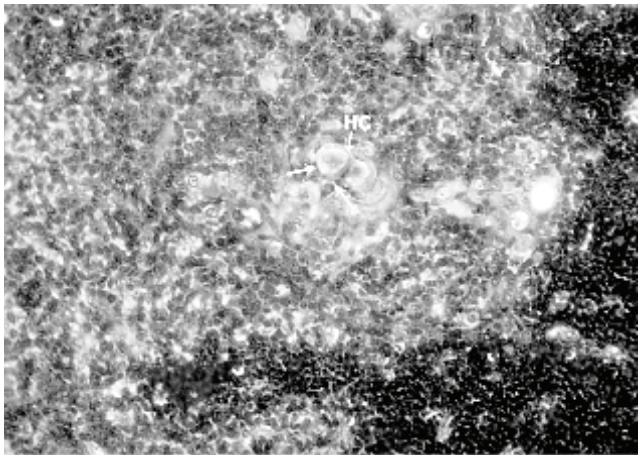

Fig 2. Photomicrograph of thymus of a day-old chick showing the reticulo-epithelial cells in the medulla. (H. & E.x400)
Hc= Hassal's corpuscles

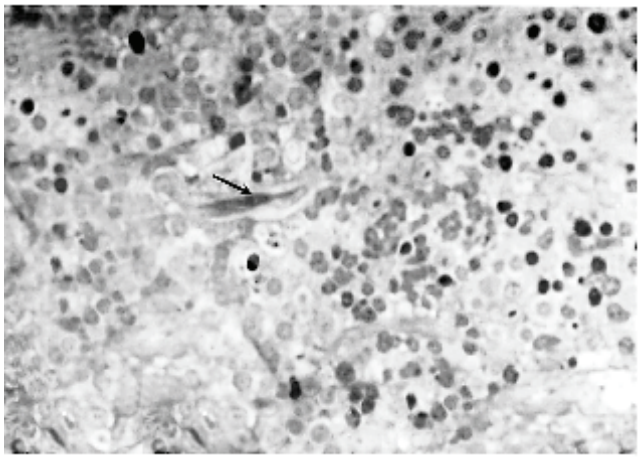

Fig 3. Photomicrograph of thymus of a twenty week-old chicken showing the myoid cell in the medulla. (Toluidine blue x 1000)

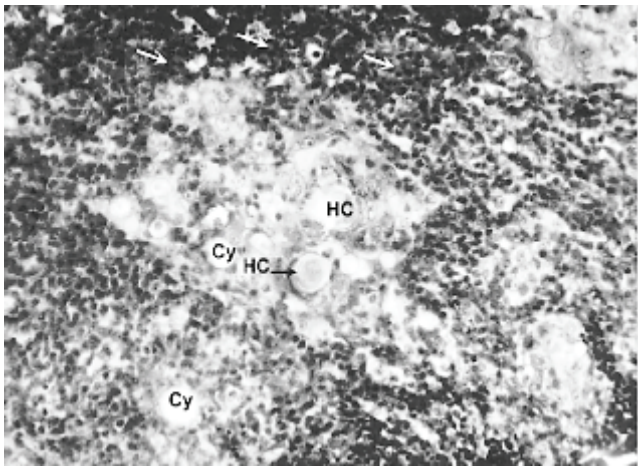

Fig 4. Photomicrograph of thymus of a day-old chick showing the presence of erythrocytes in the parenchyma. (H. & E. x 1000)
Hc=Hassal's corpuslces; Cy=Cyst

week-old birds. Karaca *et al*. (2006) reported an increase in number of mast cells with age in the thymus, bursa of Fabricius and spleen in avian species. Number of plasma cells was more in 20 week-old birds as compared to other age groups. Kendall and Frazier (1979) stated that the plasma cells were always present beneath the capsule in the perivascular space or within the connective tissue septa in avian thymus. The findings of the presence of plasma cells beneath the capsule is in contrary to the view of Ham and Cormack (1979) who have expressed that there is no possibility for the occurrence of plasma cells in the thymus, in view of its protective barrier and absence of any antigen necessary for their formation.

Various forms of granulocytes such as basophils, eosinophils and heterophils were commonly seen in the medulla of chicken. The presence of erythrocytes was observed in a small number in various locations of parenchyma in all age groups studied. The erythrocytes were found to be more in the medulla than in the cortex.

The Hassall's corpuscles were found to be a round, homogenous eosinophilic mass lined by flat reticular cells (Fig. 4). Hassall's corpuscles were commonly observed in the medulla of chicken thymus. However, the presence of Hassall's corpuscles was also noticed in the cortical areas of day-old, four weeks and ten weeks age groups. The corpuscles present in the cortex were smaller in size with few cells whereas the medullary ones were larger with more number of reticuloepithelial cells. These observations were in agreement with the findings of Vijayaragavan (1988) in chicken.

The involution was characterized by thickening of the capsule of the thymus with more collagen fibres. Depopulation of cortical lymphocytes, invasion of connective tissue into the parenchyma, increased number of Hassall's corpuscles and cysts were the features of involuting thymus. The onset of involution was observed in twenty week-old birds and marked involutary changes were noticed at forty weeks. These are in agreement with the findings of Bhattacharya and Binaykumar (1983) in chicken.

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